IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

INFERNAL TECHNOLOGY, LLC AND TERMINAL REALITY, INC., *Plaintiffs*, v. MICROSOFT CORP., *Defendant.*	Case No. 2:18-cv-00144-JRG

<u>**CLAIM CONSTRUCTION MEMORANDUM OPINION AND ORDER**</u>

This Order addresses the claim-construction disputes jointly presented by the parties in *Infernal Technology, LLC et al. v. Microsoft Corp.*, No. 2:18-cv-00144-JRG (E.D. Tex.) (the "Microsoft Case"), *Infernal Technology, LLC et al. v. Crytek GmbH*, No. 2:18-cv-00284-JRG (E.D. Tex.) (the "Crytek Case"), and *Infernal Technology, LLC et al. v. Activision Blizzard Inc.*, No. 3:18-cv-01397-M (N.D. Tex.) (the "Activision Case"). The parties submitted the same claim-construction briefing in all cases. Infernal Technology, LLC and Terminal Reality, Inc. (collectively, "Plaintiffs") submitted opening and responsive briefs (Microsoft Case, Dkt. No. 101 and Dkt. No. 107; Crytek Case, Dkt. No. 45 and Dkt. No. 47; Activision Case, Dkt. No. 93 and Dkt. No. 96). Microsoft Corp., Crytek GmbH, and Activision Blizzard Inc. (collectively "Defendants") submitted opening and responsive briefs (Microsoft Case, Dkt. No. 99 and Dkt. No. 106; Crytek Case, Dkt. No. 43 and Dkt. No. 46; Activision Case, Dkt. No. 90 and Dkt. No. 95). The U.S. District Courts for the Northern District of Texas and the Eastern District of Texas held a concurrent claim-construction hearing in these proceedings on August 16, 2019. Having considered the arguments and evidence presented by the parties at the hearing and in their briefing, the Court issues this Order.

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I.   BACKGROUND

Plaintiffs allege infringement of two U.S. Patents: No. 6,362,822 (the "'822 Patent") and No.

7,061,488 (the "'488 Patent") (collectively, the "Asserted Patents"). The application that issued as

the '488 Patent is a continuation of the application that issued as the '822 Patent, which was filed

on March 12, 1999. Each of the Asserted Patents is entitled "Lighting and Shadowing Method and

Arrangements for Use in Computer Graphic Simulations."

The Asserted Patents were construed previously in *Infernal Technology, LLC et al. v.*

Electronic Arts Inc., No. 2:15-cv-1523-JRG-RSP (E.D. Tex.) (the "EA Case"). The EA Court

issued a claim-construction order on September 27, 2016. 2016 WL 5415429 (the "*EA*

Construction"). Several of the terms in dispute here were addressed in, or include terms addressed

in, the *EA Construction*.

Each of the Asserted Patents was also the subject of Inter Partes Review before the U.S. Patent

and Trademark Office in IPR2016-00928 (the "'822 Patent IPR") and consolidated IPR2016-

00929 and IPR2016-00930 (the "'488 Patent IPR").[1] The Patent Trial and Appeal Board ("PTAB")

issued decisions instituting review of the Asserted Patents in October 2016[2] and issued final

written decisions declining to invalidate any claims of the patents in October 2017.[3] In the

institution decisions, as relevant here, the PTAB provided a preliminary claim-construction

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[1] The parties provide select excerpts from various IPR papers as exhibits. The complete papers are available to the public through the U.S. Patent and Trademark Office's Patent Trial and Appeal Board End to End System at https://ptab.uspto.gov/#/login.

[2] *Electronic Arts et al. v. Terminal Reality, Inc.*, IPR2016-00928, paper 7, 2016 WL 7093913 (PTAB Oct. 25, 2016) ("'*822 Patent IPR Institution*"); *Electronic Arts et al. v. Terminal Reality, Inc.*, IPR2016-00929, paper 7, 2016 WL 7093937 (PTAB Oct. 25, 2016) ("'*488 Patent IPR Institution*").

[3] *Electronic Arts et al. v. Terminal Reality, Inc.*, IPR2016-00928, paper 48, 2017 WL 4805200 (PTAB Oct. 23, 2017) ("'*822 Patent IPR Final*"); *Electronic Arts et al. v. Terminal Reality, Inc.*, IPR2016-00929, paper 50, 2017 WL 4764807 (PTAB Oct. 19, 2017) ("'*488 Patent IPR Final*").

analysis of "light accumulation buffer." *'822 Patent IPR Institution*, slip op. at 11–15; *'488 Patent IPR Institution,* slip op. at 12–15.

In general, the Asserted Patents are directed to technology for handling lighting and shadowing in computer graphics. The technology can be generally understood with reference to Figures 2, 3, and 4 of the '822 Patent.[4] Figure 2, reproduced here, depicts a simulated three-dimensional ("3D") scene (10). The scene includes at least one 3D object (12) that is represented by spatial data, such as polygons. And the scene is illuminated by one or more light sources (16, 18). The 3D scene is rendered in two dimensions ("2D") and the 2D image is suitable for display, such as on


'822 Patent Figure 2
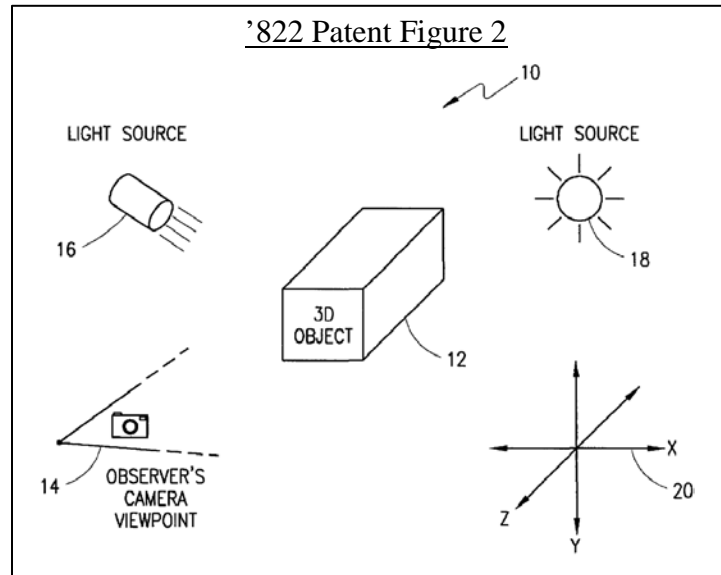
a computer screen. The 2D view of the 3D scene is from the observer's, or camera's (14), perspective and takes into account the light incident on the 3D object as viewed from the observer's perspective. The relative positions of the object, observer, and light sources are defined using a 3D coordinate system (20). '822 Patent col.1 ll.25–38, col.6 ll.28–57.

Figures 3 and 4, reproduced below, depict exemplary data structures and an image processing flow for producing an image for display. The scene is rendered into 2D from the observer's (camera's) view (step 102) and also from each light source's view (step 104). The 2D data for each view include image (e.g., color) and depth information associated with each point in the view's

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[4] The disclosures of the '822 Patent and the '488 Patent are substantially the same. As such, the Court cites the '822 Patent, understanding that the cited material is also in the '488 Patent.

2D coordinate system (data structures 51A, 51B, 51C, 51D, 51E, 51F). The 2D version of the

scene from the observer's view is transformed from the observer's coordinate system to the light

source's coordinate system (step 106) and for each region in the observer's view that is illuminated

by the light source, the light image information is accumulated in a light source buffer (data

structure 51G) (step 108). After the observer data is processed for each light source to generate the

accumulated light data, the accumulated light data is combined with the observer data to generate

the image for display (data structure 50; step 118). *Id*. at col.6 l.58 – col.9 l.22.

Figure 3

Figure 4
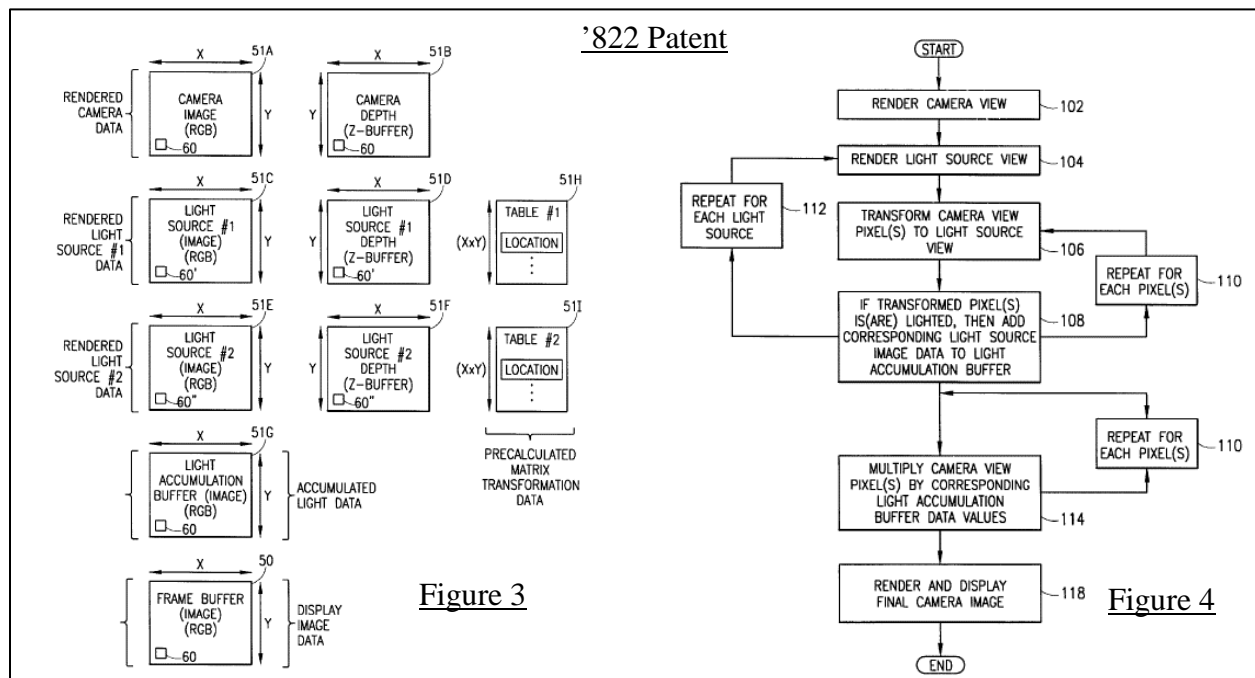
The abstracts of the Asserted Patents are identical and provide:

> The effects of lighting and resulting shadows within a computer simulated three-dimensional scene are modeled by rendering a light depth image and a light color image for each of the light sources. The light depth images are compared to a camera depth image to determine if a point within the scene is lighted by the various light sources. An accumulated light image is produced by combining those portions of the light color images determined to be lighting the scene. The resulting accumulated light image is then combined with a camera color image to produce a lighted camera image that can be further processed and eventually displayed on a computer display screen. The light color image can be static or dynamic. Transformations between different perspective and/or coordinate systems can be precalculated for fixed cameras or light sources. The various images and

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manipulations can include individual pixel data values, multiple-pixel values, polygon values, texture maps, and the like.

Claim 1 of the '822 Patent and Claim 11 of the '488 Patent, exemplary method and system claims respectively, recite as follows:

'822 Patent Claim 1:
A shadow rendering method for use in a computer system, the method comprising the steps of:
  providing observer data of a simulated multi-dimensional scene;
  providing lighting data associated with a plurality of simulated light sources arranged to illuminate said scene, said lighting data including light image data;
  for each of said plurality of light sources, comparing at least a portion of said observer data with at least a portion of said lighting data to determine if a modeled point within said scene is illuminated by said light source and storing at least a portion of said light image data associated with said point and said light source in a light accumulation buffer; and then
  combining at least a portion of said light accumulation buffer with said observer data; and
  displaying resulting image data to a computer screen.

'488 Patent Claim 11:
An arrangement configured to render shadows in a simulated multi-dimensional scene, the arrangement comprising:
  an output to a display screen configured to display image data;
  memory for storing data including observer data associated with a simulated multi-dimensional scene, and lighting data associated with a plurality of simulated light sources arranged to illuminate said scene, said lighting data including light image data, said memory further including a light accumulation buffer portion and a frame buffer portion;
  at least one processor coupled to said memory and said output and operatively configured to, for each of said plurality of light sources, compare at least a portion of said observer data with at least a portion of said lighting data to determine if a modeled point within said scene is illuminated by said light source and storing at least a portion of said light image data associated with said point and said light source in said light accumulation buffer, then combining at least a portion of said light accumulation buffer with said observer data, and storing resulting image data in said frame buffer, and outputting at least a portion of said image data in said frame buffer via said output.

Plaintiffs allege that Microsoft has infringed Claims 1–3 of the '822 Patent and Claims 1–3, 11–16, and 27–29 of the '488 Patent by making, using, and selling certain video games, gaming consoles, and laptop computers. (Dkt. No. 101 at 11–12.)

II.   LEGAL PRINCIPLES

A.   Claim Construction

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Innova/Pure Water Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). To determine the meaning of the claims, courts start by considering the intrinsic evidence. *Id.* at 1313; *C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 861 (Fed. Cir. 2004); *Bell Atl. Network Servs., Inc. v. Covad Commc'ns Group, Inc.*, 262 F.3d 1258, 1267 (Fed. Cir. 2001). The intrinsic evidence includes the claims themselves, the specification, and the prosecution history. *Phillips*, 415 F.3d at 1314; *C.R. Bard, Inc.*, 388 F.3d at 861. The general rule—subject to certain specific exceptions discussed *infra*—is that each claim term is construed according to its ordinary and accustomed meaning as understood by one of ordinary skill in the art at the time of the invention in the context of the patent. *Phillips*, 415 F.3d at 1312–13; *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1368 (Fed. Cir. 2003); *Azure Networks, LLC v. CSR PLC*, 771 F.3d 1336, 1347 (Fed. Cir. 2014) ("There is a heavy presumption that claim terms carry their accustomed meaning in the relevant community at the relevant time.") (vacated on other grounds).

"The claim construction inquiry … begins and ends in all cases with the actual words of the claim." *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1248 (Fed. Cir. 1998). "[I]n all aspects of claim construction, 'the name of the game is the claim.'" *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1298 (Fed. Cir. 2014) (quoting *In re Hiniker Co.*, 150 F.3d 1362, 1369 (Fed.

Cir. 1998)). First, a term's context in the asserted claim can be instructive. *Phillips*, 415 F.3d at 1314. Other asserted or unasserted claims can also aid in determining the claim's meaning, because claim terms are typically used consistently throughout the patent. *Id.* Differences among the claim terms can also assist in understanding a term's meaning. *Id*. For example, when a dependent claim adds a limitation to an independent claim, it is presumed that the independent claim does not include the limitation. *Id*. at 1314–15.

"[C]laims 'must be read in view of the specification, of which they are a part.'" *Id*. (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc)). "[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Id*. (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)); *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002). But, "'[a]lthough the specification may aid the court in interpreting the meaning of disputed claim language, particular embodiments and examples appearing in the specification will not generally be read into the claims.'" *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1187 (Fed. Cir. 1998) (quoting *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1571 (Fed. Cir. 1988)); *see also Phillips*, 415 F.3d at 1323. "[I]t is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited." *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 913 (Fed. Cir. 2004).

The prosecution history is another tool to supply the proper context for claim construction because, like the specification, the prosecution history provides evidence of how the U.S. Patent and Trademark Office ("PTO") and the inventor understood the patent. *Phillips*, 415 F.3d at 1317.

However, "because the prosecution history represents an ongoing negotiation between the PTO and the applicant, rather than the final product of that negotiation, it often lacks the clarity of the specification and thus is less useful for claim construction purposes." *Id.* at 1318; *see also Athletic Alternatives, Inc. v. Prince Mfg.*, 73 F.3d 1573, 1580 (Fed. Cir. 1996) (ambiguous prosecution history may be "unhelpful as an interpretive resource").

Although extrinsic evidence can also be useful, it is "'less significant than the intrinsic record in determining the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317 (quoting *C.R. Bard, Inc.*, 388 F.3d at 862). Technical dictionaries and treatises may help a court understand the underlying technology and the manner in which one skilled in the art might use claim terms, but technical dictionaries and treatises may provide definitions that are too broad or may not be indicative of how the term is used in the patent. *Id*. at 1318. Similarly, expert testimony may aid a court in understanding the underlying technology and determining the particular meaning of a term in the pertinent field, but an expert's conclusory, unsupported assertions as to a term's definition are not helpful to a court. *Id*. Extrinsic evidence is "less reliable than the patent and its prosecution history in determining how to read claim terms." *Id*. The Supreme Court has explained the role of extrinsic evidence in claim construction:

> In some cases, however, the district court will need to look beyond the patent's intrinsic evidence and to consult extrinsic evidence in order to understand, for example, the background science or the meaning of a term in the relevant art during the relevant time period. *See, e.g., Seymour v. Osborne*, 11 Wall. 516, 546 (1871) (a patent may be "so interspersed with technical terms and terms of art that the testimony of scientific witnesses is indispensable to a correct understanding of its meaning"). In cases where those subsidiary facts are in dispute, courts will need to make subsidiary factual findings about that extrinsic evidence. These are the "evidentiary underpinnings" of claim construction that we discussed in *Markman*, and this subsidiary factfinding must be reviewed for clear error on appeal.

Teva Pharm. USA, Inc. v. Sandoz, Inc., 135 S. Ct. 831, 841 (2015).

B.   Departing from the Ordinary Meaning of a Claim Term

There are "only two exceptions to [the] general rule" that claim terms are construed according to their plain and ordinary meaning: "1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of the claim term either in the specification or during prosecution."[5] *Golden Bridge Tech., Inc. v. Apple Inc.*, 758 F.3d 1362, 1365 (Fed. Cir. 2014) (quoting *Thorner v. Sony Computer Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)); *see also GE Lighting Solutions, LLC v. AgiLight, Inc.*, 750 F.3d 1304, 1309 (Fed. Cir. 2014) ("[T]he specification and prosecution history only compel departure from the plain meaning in two instances: lexicography and disavowal."). The standards for finding lexicography or disavowal are "exacting." *GE Lighting Solutions*, 750 F.3d at 1309.

To act as his own lexicographer, the patentee must "clearly set forth a definition of the disputed claim term," and "clearly express an intent to define the term." *Id.* (quoting *Thorner*, 669 F.3d at 1365); *see also Renishaw*, 158 F.3d at 1249. The patentee's lexicography must appear "with reasonable clarity, deliberateness, and precision." *Renishaw*, 158 F.3d at 1249.

To disavow or disclaim the full scope of a claim term, the patentee's statements in the specification or prosecution history must amount to a "clear and unmistakable" surrender. *Cordis Corp. v. Boston Sci. Corp.*, 561 F.3d 1319, 1329 (Fed. Cir. 2009); *see also Thorner*, 669 F.3d at 1366 ("The patentee may demonstrate intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope."). "Where an applicant's statements are amenable

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[5] Some cases have characterized other principles of claim construction as "exceptions" to the general rule, such as the statutory requirement that a means-plus-function term is construed to cover the corresponding structure disclosed in the specification. *See, e.g., CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1367 (Fed. Cir. 2002).

to multiple reasonable interpretations, they cannot be deemed clear and unmistakable." *3M Innovative Props. Co. v. Tredegar Corp.*, 725 F.3d 1315, 1326 (Fed. Cir. 2013).

III.   AGREED CONSTRUCTIONS

The parties have agreed to the following constructions set forth in their Joint Patent Rule 4-5(d) Claim Construction Chart (Dkt. No. 109).

Term[6]	Agreed Construction
"providing" • '822 Patent Claim 1 • '488 Patent Claims 1, 27	making available
"observer data of a simulated multi-dimensional scene" • '822 Patent Claim 1 • '488 Patent Claims 1, 27	data representing at least the color of objects in a simulated multi-dimensional scene as viewed from an observer's perspective
"observer data associated with a simulated multi-dimensional scene" • '488 Patent Claim 11	
"a modeled point within said scene" • '822 Patent Claims 1, 6 • '488 Patent Claims 1, 11, 27	a point on a modeled object within said scene
order of the comparing, storing, and combining steps • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	the comparing and storing steps are completed before beginning the combining step
"displaying resulting image data to a computer screen" • '822 Patent Claim 1	displaying the image data resulting from combining at least a portion of the light accumulation buffer with the observer data on a computer screen

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[6] For all term charts in this order, the claims in which the term is found are listed with the term but: (1) only the highest-level claim in each dependency chain is listed, and (2) only asserted claims identified in the parties' Joint Patent Rule 4-5(d) Claim Construction Chart (Dkt. No. 109) are listed.

Term[6]	Agreed Construction
"outputting resulting image data" • '488 Patent Claims 1, 27	outputting for presentation to a user the image data resulting from combining at least a portion of the light accumulation buffer with the observer data
"combining at least a portion of said light accumulation buffer with said observer data" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	combining at least a portion of the data in the light accumulation buffer with said observer data • subject to having the terms (1) "at least a portion of," (2) "light accumulation buffer" and (3) "observer data" construed by the Court
"A computer-readable medium carrying at least one set of computer instructions configured to cause at least one processor to operatively render simulated shadows in a multidimensional simulated scene" • '488 Patent Claim 27	the preamble is limiting

Having reviewed the intrinsic and extrinsic evidence of record, the Court hereby adopts the

parties' agreed constructions.

IV.   CONSTRUCTION OF DISPUTED TERMS

A.   The Preambles of Claim 1 of the '822 Patent and Claims 1 and 11 of the '488 Patent

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"A shadow rendering method for use in a computer system" • '822 Patent Claim 1	the preamble is not limiting and no construction is necessary	the preamble is limiting
"A shadow rendering method" • '488 Patent Claim 1	the preamble is not limiting and no construction is necessary	the preamble is limiting

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"An arrangement configured to render shadows in a simulated multidimensional scene"[7] • '488 Patent Claim 11	the preamble is not limiting and no construction is necessary	the preamble is limiting

Because the parties' arguments and proposed constructions with respect to these terms are related, the Court addresses the terms together.

The Parties' Positions

Plaintiffs submit: The limitations recited in the bodies of Claim 1 of the '822 Patent and Claims 1 and 11 of the '488 Patent define structurally complete inventions without need for reference to the preambles. The preambles do not provide antecedent basis for any terms in the bodies of the claims and the preambles were not relied upon during prosecution of the Asserted Patents. Rather, the preambles simply provide an intended use or name for the limitations recited in the bodies of the claims. As such, the preambles are not limiting. (Dkt. No. 101 at 16–19, 31–32.)

Defendants submit: The preambles are limiting because they provide an important aspect of the inventions that is not apparent solely from the bodies of the claims; namely, that the claimed inventions are directed to improvements in shadow rendering in 3D computer graphics, and not simply to general lighting in 3D computer graphics. The Asserted Patents critique the shortcomings of prior-art shadow rendering and explain that the inventions are directed specifically to addressing these shortcomings with inventions based on additively lighting unshaded portions of objects (as opposed to the disparaged prior-art approach of additively

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[7] This term in the '488 Patent applies only to the Microsoft Case. (Dkt. No. 109-1 at 4 n.1.)

darkening shaded objects). This was further explained by the patentee during inter partes review of the patents, where it represented that "the point of the invention is to render light and shadows." In other words, the claims are directed to "rendering the occlusion of modeled points from light sources … by other objects." This does not encompass simply determining whether a "light source is too far away from a given point to have any effect on it at all." (Dkt. No. 99 at 15–21.)

In addition to the claims themselves, Defendants cite the following intrinsic evidence to support their position: '822 Patent col.1 ll.57–59, col.2 ll.1–3, col.2 ll.7–10, col.2 ll.13–18, col.2 ll.36–38, col.2 ll.50–56, col.3 ll.8–9, col.7 ll.49–53, col.8 ll.62–67; James D. Foley et al., *Computer Graphics: Principles and Practice* at 747 (2d ed. 1997) ("*Foley*") (Defendants' Ex. C, Dkt. No. 99-1 at 46–68); '822 Patent IPR Hr'g Tr.[8] at 44–45 (Defendants' Ex. J, Dkt. No. 99-1 at 199–204).

Plaintiffs respond: Defendants have not provided evidence sufficient to disregard the general rule that preambles are not limiting. The preambles state that shadow rendering is the intended purpose of the claimed invention but the claims define structurally complete methods for achieving this purpose. As explained in the Asserted Patents, the claims are directed to determining whether a modeled point is illuminated, and a point is "shaded" if it is not illuminated. This encompasses more than simply determining whether a point is occluded from the light source and indeed encompasses determining whether a light source is too far away to illuminate the point. (Dkt. No. 107 at 6–15.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent, at [54] Title, [57] Abstract, col.1 ll.6–16, col.2 ll.15–16, col.3 ll.6–35, col.4 ll.20–24, col.7 ll.43–52, col.8 ll.57–63, col.12 ll.13–15.

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[8] Record of Oral Hearing Held July 18, 2017, *Electronic Arts et al. v. Terminal Reality, Inc.*, IPR2016-00928, Paper 47 (also addressing IPR2016-00929 and IPR2016-00930).

Defendants respond: The Asserted Patents explain that shadow rendering is what the inventor actually invented and intended to cover with the claims. The preambles in the claims at issue are limiting because they recite "an essential characteristic of the system that informs the remainder of the claim." Specifically, the claims require "that the image ultimately output for display must include shadows rendered by the preceding steps." (Dkt. No. 106 at 7–12.)

<u>Analysis</u>

The issue in dispute distills to whether the preambles' recitation of "shadow rendering" or "render shadows" should be construed to require the claims to include an occlusion limitation. They should not.

Under Federal Circuit precedent "a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention." *Acceleration Bay, LLC v. Activision Blizzard, Inc.*, 908 F.3d 765, 770 (Fed. Cir. 2018) (quotation marks and citations omitted). Likewise, a preamble is not limiting when it "merely gives a descriptive name to the set of limitations in the body of the claim that completely set forth the invention." *Am. Med. Sys. v. Biolitec, Inc.*, 618 F.3d 1354, 1359 (Fed. Cir. 2010). A preamble is limiting, however, when it is "necessary to give life, meaning, and vitality to the claim." *Catalina Mktg. Int'l v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (quotation marks omitted). For example, "dependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention." *Id*. "Likewise, when the preamble is essential to understand limitations or terms in the claim body, the preamble limits claim scope." *Id*. "Further, when reciting additional structure or steps underscored as important by the specification, the preamble may operate as a claim limitation." *Id*.

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Here, the preambles do not add anything to the body of the claims. Each claim sets forth a complete method of lighting a scene in a way that will render shadows as appropriate and consistent with what the patentee described as the invention. Therefore, the preambles are not limiting.

The Court is not persuaded by Defendants' argument based on *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251 (Fed. Cir. 1989). In *Corning*, the body of the patent claim was directed to an optical fiber without any reference to the waveguide attributes of the invention. *Id*. at 1256. These waveguide attributes were specified in the patent as an important feature of the invention and required structural limitations on the fiber that were not apparent in the claim body. That is, the *Corning* invention was clearly an optical waveguide but the claim body gave no effect to the waveguide aspect of the invention. *Id*. at 1256–57. Thus, the preamble recitation of "optical waveguide" was limiting. *Id*. As set forth below, the claims at issue here are distinguishable from the claim in *Corning* because the claims here capture the key features of the invention in the bodies of the claims.

Here, the claims are analogous to the claim addressed in *Georgetown Rail Equip. Co. v. Holland L.P.*, 867 F.3d 1229 (Fed. Cir. 2017). The preamble of the claim at issue in *Georgetown* recited a "system for inspecting a railroad track bed, including the railroad track, to be mounted on a vehicle for movement along the railroad track." *Id*. at 1234. While the phrase "mounted on a vehicle for movement along the railroad track" was deemed by the Federal Circuit to describe the "principal intended use of the invention," it was held not limiting. *Id*. at 1236–37. The Federal Circuit held that the "location of the system is not an essential feature of the invention," as the patent provided that it may be located other than on the vehicle. *Id*. Thus, the preamble recitation of "mounted on a vehicle for movement along the railroad track" was not limiting.

Here, the bodies of the claims at issue capture the key aspects of the invention without reference to the preambles and therefore are more akin to the claim addressed in *Georgetown* than the claim addressed in *Corning*. The Asserted Patents are directed to technology for "rendering lighting and shadows in computer graphic simulations." '822 Patent col.1 ll.7–9; *see also*, *id*. at col.3 ll.6–17 ("improved lighting and shadowing methods and arrangements are provided … [that] allow for multiple light sources to be modeled"). This is accomplished by accumulating light data for lit objects in the scene of the simulation. *See, e.g., id*. at col.3 ll.25–30. The technology may be used for rendering shadows as well as other lighting effects. For example, it "can also be used to simulate dynamically changing light sources, interrupted light beams, reflected light beams, and/or projected light images, such as, for example, motion picture, video, animation, and computer graphics images." *Id*. at col.3 l.64 – col.4 l.2; *see also, id*. at col.10 l.63 – col.11 l.13 (noting that the invention may be used, e.g., "to simulate light that is reflected from changing surfaces, … [and] an animation, motion picture or similar video image that is projected"). In other words, there are a variety of intended uses for the invention. As in the *Georgetown* claim, the preambles here recite the primary intended use of the invention, namely, shadow rendering, but do not recite an essential feature of the invention. As the claims at issue here include bodies that define structurally complete inventions, the preambles each represent a nonlimiting statement of intended use.

Accordingly, the Court determines that the preambles of Claim 1 of the '822 Patent and of Claims 1 and 11 of the '488 Patent are not limiting.

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B.   **"determine if a modeled point within said scene is illuminated by said light source"**

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"determine if a modeled point within said scene is illuminated by said light source" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	determining if a point on a modeled object within said scene is illuminated by said light source	calculate whether a modeled point is lighted by, or shaded from, said light source

The Parties' Positions

Plaintiffs submit: The words "determine" and "illuminated" are readily understood without construction and construing them as Defendants propose would improperly change the scope of the claims. Specifically, "determine" should not be rewritten as "calculate." The words either mean the same thing, in which case rewriting is unnecessary, or they mean different things, in which case rewriting is improper. Further, "illuminate" should not be rewritten as "lighted by, or shaded from." "Illuminated" is used in the Asserted Patents according to its plain meaning, i.e., "lit," and there is no support for injecting a "or shaded from" limitation into the construction. (Dkt. No. 101 at 24–26.)

In addition to the claims themselves, Plaintiffs cite the following intrinsic evidence to support their position: '822 Patent col.2 ll.15–18, col.8 ll.66–67.

Defendants submit: This limitation "refer[s] to an algorithm that calculates whether the point being modeled is shaded from the light source by another object in the scene." The Asserted Patents consistently and solely describe determining whether a point is illuminated as determining whether it "is lighted by, or shaded from, [the] light source" in the context of updating the light accumulation buffer if it is lit and not updating the buffer if the point "is not lighted (i.e., is

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shaded)" (quoting '822 Patent col.8 ll.62–67). Essentially, the point is illuminated if it is not shaded and determining whether it is illuminated requires determining whether it is shaded. As consistently and solely described in the patents, this is accomplished by comparing depth data for the point with that for the light source to determine if the point is hidden from the light source by another object (shaded). This is how Plaintiffs' experts in the EA Case and Inter Partes Reviews explained the determining step. Ultimately, calculating whether a point is lighted by or shaded from the light source is "a fundamental characteristic of the invention" rather than an exemplary embodiment. (Dkt. No. 99 at 21–26.)

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: Intrinsic evidence: '822 Patent col.2 ll.36–56, col.3 ll.8–9, col.7 ll.26–29, col.7 ll.41–43, col.8 ll.62–67, col.9 ll.35–44; '822 Patent IPR Laub Decl. ¶¶ 41, 59 (Defendants' Ex. L, Dkt. No. 99-1 at 210–24). Extrinsic evidence: EA Case Ferraro Decl. ¶ 15 (Defendants' Ex. E, Dkt. No. 99-1 at 107–18).

Plaintiffs respond: The claims do not mention determining whether a point is shaded, only whether it is illuminated. The statements of Plaintiffs' expert in the '822 Patent IPR that Defendants rely on do not equate "determine if a modeled point … is illuminated by said light source" with "calculating whether a modeled point is lighted by, or shaded from, said light source." Rather, the expert provided an example of a situation when an object is not illuminated by a light source (a shaded object is not illuminated). Similarly, the statement of Plaintiffs' expert in the EA Case that Defendants rely on simply reflects that the claims require determining whether the point is illuminated. (Dkt. No. 107 at 15–19.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent, at [57] Abstract.

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Defendants respond: The Asserted Patents equate determining whether a point is illuminated with determining whether it is shaded. Thus, the "determine if a modeled point within said scene is illuminated by said light source" limitation does not encompass just any test for whether the source effects the point, "e.g., whether it is too far away." (Dkt. No. 106 at 13–15.)

Analysis

The issue in dispute is whether the "determine if a modeled point … is illuminated by said light source" limitation requires a calculation of whether the point is lighted by or shaded from the light source. It does not. While a shaded point is not illuminated by a light source, there are other instances in which a point is not illuminated by a light source.

As set forth above in the section addressing the dispute as to the preambles, the Asserted Patents expressly state that the lighting and shading methods are applicable to modeling dynamically changing light sources that may variably illuminate, or not, a point in the scene without consideration of intervening objects that may shade the point from the light source. Thus, contrary to Defendants' contention, the Asserted Patents do not meet the exacting standard to redefine "illuminated" as "not shaded." Further, the patents specifically disclose directional light sources that may not illuminate a point by virtue of the direction. *See, e.g.*, '822 Patent col.6 ll.41– 43 ("Light source #1, in this example, is a uni-directional light source having a particular position, orientation and constrained field-of-view."), col.10 ll.40–43 ("These light sources, which are not shown in FIG. 7C, are directional light sources having fixed positions with respect to room 200."). The patents provide that transformation between the light-source coordinate system and the observer (camera) coordinate system may determine whether the light from the light source illuminates a point. *See, e.g.*, *id.* at col.8 ll.9–11 ("Thus, the resulting transformation table #1 can be used to quickly *determine which, if any, of pixels* 60' (light image) correspond to a specific

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pixel 60 (camera image)." (emphasis added)). That is, light from the source is not added to the

modeled point if it is not directed to the modeled point—the source does not illuminate the point

when there is no overlap of the light image and the camera image. This is determined through the

transformation between camera view and light-source view. *See also, id*. at col.11 ll.28–35 (noting

a light source facing in a direction such as to not illuminate an object (man) in the scene).

Accordingly, the Court construes this term as follows:

- "determine if a modeled point within said scene is illuminated by said light

  source" means "determine if a point on a modeled object within said scene is

  illuminated by said light source."

C.   **"providing lighting data associated with a plurality of simulated light sources arranged to illuminate said scene, said lighting data including light image data"**

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"providing lighting data associated with a plurality of simulated light sources arranged to illuminate said scene, said lighting data including light image data" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	"lighting data" should be construed to have its plain and ordinary meaning (i.e., "data relating to the representation of simulated light sources arranged to illuminate said scene")	Light image data is required for each of a plurality of light sources. "lighting data" means "2D color and depth data, for a plurality of simulated light sources"

The Parties' Positions

Plaintiffs submit: As explained in the Asserted Patents, "lighting data" is not limited to "2D

color and depth data." Rather, 2D color and depth data is described as exemplary in the patents

and appears expressly in dependent claims (e.g., '822 Patent Claim 4) indicating that "lighting

data" is not inherently limited to 2D color and depth data. (Dkt. No. 101 at 19–22.)

In addition to the claims themselves, Plaintiffs cite the following **intrinsic evidence** to support their position: '822 Patent col.3 ll.36–51, col.6 ll.41–43, col.12 ll.32–37.

Defendants submit: The Asserted Patents provide that "lighting data" must include at least color data and depth data and that this data must be 2D data. Plaintiffs, and their experts, stated in the EA Case and in the '822 Patent IPR that "lighting data" necessarily includes 2D color data and depth data for a plurality of simulated light sources. In the '822 Patent IPR, Plaintiffs distinguished prior art based on the fact that lighting data includes 2D color data and depth data. Finally, as explained in the patents and by Plaintiffs in the EA Case and in the '822 Patent IPR, lighting data includes 2D color data and depth data for each of a plurality of light sources. (Dkt. No. 99 at 26–34.)

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: Intrinsic evidence: '822 Patent figs.3–4, col.3 ll.41–51, col.4 ll.24–28, col.4 ll.55–56, col.6 l.58 – col.7 l.42, col.8 ll.42–44, col.9 ll.3–8, col.9 ll.31–34, col.10 ll.63–65; '822 Patent IPR Patent Owner Preliminary Response at 7–8 (Defendants' Ex. H, Dkt. No. 99-1 at 181–91), Patent Owner Response at 3–5 (Defendants' Ex. I, Dkt. No. 99-1 at 192–98), Hrn'g Tr. at 36 (Defendants' Ex. J, Dkt. No. 99-1 at 199–204), Laub Decl.[9] ¶¶ 56–57, 61, 78–79, 83–84 (Defendants' Ex. L, Dkt. No. 99-1 at 210–24). Extrinsic evidence: EA Case Ferraro Decl.[10] ¶¶ 10, 12, 16 (Defendants' Ex. E, Dkt. No. 99-1 at 107–18).

Plaintiffs respond: That lighting data is provided by each of a plurality of light sources is required by other claim language. Including a "for each of a plurality of light sources" limitation in the construction of "lighting data" therefore threatens to confuse rather than clarify claim scope.

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[9] Declaration of Leonard Laub, IPR2016-00928, Exhibit 2008.

[10] Declaration of Richard F. Ferraro, EA Case, Dkt. No. 77-3.

The 2D color and depth data described in the Asserted Patents is exemplary, not definitional. Specifically, the patents provide that "the data in the light image … can represent the intensity, color, and/or pattern of light emitted" (quoting '822 Patent col.7 ll.32–34). Certain dependent claims (Claims 4, 14, and 42 of the '822 Patent and Claims 4, 14, and 30 of the '488 Patent) expressly require the "lighting data" to include source and color data so it would be improper to require "lighting data" to inherently include these limitations in the independent claims. The statements by the experts in the EA Case and the '822 Patent IPR that Defendants rely on are descriptions of lighting data in the context of the exemplary embodiment of Figure 3 of the patents and are not opinions on inherent characteristics of the claimed invention. Finally, the distinction between the claims and the prior art that was presented in the '822 Patent IPR is that the prior art reference "does not teach that M1 is a look-up table that includes lighting data coordinates." This is not a disclaimer that limits "lighting data" to 2D color and depth data. (Dkt. No. 107 at 19–25.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent fig.3, col.3 l.63 – col.4 l.5, col.5 ll.28–31, col.6 ll.38–48, col.6 ll.59–60, col.7 ll.32–34; '822 Patent IPR Laub Decl. ¶ 151.[11]

Defendants respond: Plaintiffs argued in the EA Case that lighting data was 2D data and the EA Court accepted that position. As such, Plaintiffs are estopped from taking a different position here. Further, Plaintiffs' expert in the EA Case stated that the "lighting data" of the invention is "2D color data and depth data for a plurality of simulated light sources." Plaintiffs and their expert in the '822 Patent IPR distinguished the lighting data of the Asserted Patents from that in the prior art on the ground that the prior art disclosed only depth data, and did not include illumination data.

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[11] Paragraph 151 of the Laub declaration was not submitted by the parties. The declaration is available to the public through the U.S. Patent and Trademark Office's Patent Trial and Appeal Board End to End System at https://ptab.uspto.gov/#/login.

Plaintiffs also argued in the '822 Patent IPR that the claimed invention is distinct over the prior art because it includes manipulation of 2D images. Finally, "lighting data" is used consistently in the patents to refer to data that includes at least "2D color data and depth data." This mandates the conclusion that "2D color data and depth data" is not merely exemplary of the "lighting data" of the patents, but rather is necessarily included in the "lighting data" of the patents. (Dkt. No. 106 at 15–23.)

Defendants cite further intrinsic and extrinsic evidence to support their position: Intrinsic evidence: '822 Patent IPR Patent Owner Preliminary Response at 1, 2, 5 (Defendants' Ex. H, Dkt. No. 99-1 at 181–91). Extrinsic evidence: EA Case Ferraro Decl. ¶ 17 (Defendants' Ex. E, Dkt. No. 99-1 at 107–18).

Analysis

There are two issues submitted to the Court, one of which is essentially undisputed: first, whether "lighting data" is necessarily provided for each of the plurality of light sources, and second, whether "lighting data" necessarily includes "2D color data and depth data." As for the first issue, lighting data is necessarily provided, but this is plainly expressed in the claims and is not in dispute. Therefore, this limitation does not need to be incorporated into a construction of "lighting data." As for the second issue, "lighting data" expressly includes "light image data," which, as explained below, necessarily includes 2D data. However, it does not necessarily include color and depth data. Therefore, "lighting data" does not need to be construed apart from "light image data."

The parties agree that lighting data is provided for each of a plurality of light sources. Since there is no dispute, there is no need for the court to issue a construction to resolve the dispute.

The patents do not teach that "lighting data" necessarily includes color and depth data. The independent claims at issue recite that lighting data includes light image data ("said lighting data including light image data") but otherwise do not specify the content of lighting data. The Asserted Patents provide that "*in certain embodiments*, the lighting data includes source color data associated with at least one of the light sources and source depth data associated with the plurality of modeled polygons within the scene as rendered from a plurality of different light source's perspectives." '822 Patent col.3 ll.47–52 (emphasis added). Indeed, dependent Claim 4 of the '822 Patent is directed to such an embodiment: "said lighting data includes source color data associated with at least one of said light sources and source depth data associated with said plurality of modeled polygons within said scene as rendered from a plurality of different light source's perspectives." *Id*. at col.12 ll.32–37. This suggests that light-source color and depth data is not inherently included in "lighting data." *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc) (noting that the use of the term "steel baffles" "strongly implies that the term 'baffles' does not inherently mean objects made of steel"). Further, the Court is not persuaded by Defendants' argument that the description of the data structures of Figure 3 of the Asserted Patents mandates that lighting data must include 2D color and depth data. At the beginning of this description the patents provide: "FIG. 3 is a block diagram depicting *exemplary arrangements* of modeling data as used to render lighting and shadows, in accordance with *certain embodiments* of the present invention." *Id*. at col.6 ll.58–61 (emphasis added). That is, what Defendants proffer as definitional is expressly not definitional. To the extent Plaintiffs' expert in the EA Case offered any opinion that "lighting data" inherently includes color and depth data, that opinion is at odds with the intrinsic record. As such, rather than somehow being definitional of a claim term, as Defendants suggest, this testimony should be disregarded. *See Phillips v. AWH Corp.*, 415 F.3d

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1303, 1318 (Fed. Cir. 2005) (en banc) ("a court should discount any expert testimony that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent" (quotation marks omitted)). The Court is also not persuaded that anything said by Plaintiffs or their expert in the Inter Partes Reviews, as of record here, rises to the level of disclaimer that would require "lighting data" to necessarily include color and depth data.

As set forth below, the Court understands that "light image data" is necessarily two-dimensional (2D) data. Thus, "lighting data" necessarily includes 2D data because it expressly includes "light image data." Reflecting this in a construction of "lighting data," however, is unnecessary and potentially misleading. For example, it could suggest that "lighting data" necessarily includes data beyond "light image data," which is not the case.

Accordingly, the Court determines there is no dispute regarding whether there is lighting data for a plurality of simulated light sources, that "lighting data" does not inherently include color and depth data, and that the term has its plain and ordinary meaning and does not need to be otherwise construed apart from "light image data," which it expressly includes.

D.   "light image data"

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"light image data" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	for each of the plurality of light sources, data representing an image of the light emitted by the light source to illuminate the scene as viewed from the light source's perspective	for each of the plurality of light sources, pixel data values representing the light emitted by the light source to illuminate the scene as viewed from the light source's perspective

The Parties' Positions

Plaintiffs submit: In the *EA Construction*, the EA Court held that "light image data" was not limited to "pixel data values," but rather encompasses data structures other than pixels and data for a single pixel. There is no reason to deviate from the *EA Construction*. (Dkt. No. 101 at 20, 22–23.)

Defendants submit: The construction of "light image data" set forth in the *EA Construction* does not resolve the dispute between the parties here; namely, whether "light image data" must represent pixel data. As consistently and repeatedly described in the Asserted Patents, the light image data is pixels. Further, light image data must be in the form of pixels, or the claimed method cannot add the light image data to the light accumulation buffers for the pixels that are illuminated. In the '822 Patent IPR, Plaintiffs represented that the "light image data" are pixels, that this is an important aspect of the invention, and that this aspect is a distinction over the prior art. (Dkt. No. 99 at 34–37.)

In addition to the claims themselves, Defendants cite the following intrinsic evidence to support their position: '822 Patent figs.3–4, col.3 ll.40–52, col.4 ll.32–35, col.7 ll.15–17, col.7 ll.19–22, col.7 ll.30–32, col.7 ll.34–37, col.8 ll.8–10, col.8 ll.23–27, col.8 ll.45–47, col. 8 ll.57–60, col.8 ll.62–66, col.10 ll.63–66, col.11 ll.51–56; '822 Patent IPR Patent Owner Preliminary Response at 1–2, 5, 7–8, 11 (Defendants' Ex. H, Dkt. No. 99-1 at 181–91), Laub Decl. ¶¶ 56–57 (Defendants' Ex. L, Dkt. No. 99-1 at 210–24).

Plaintiffs respond: The Asserted Patents expressly provide that light image data may be formed as pixel values but that "other conventions and/or arrangements can also be used for storing and manipulating the data" (quoting '822 Patent col.7 ll.1–3). For example, and as explained in *Foley*, which is incorporated into the Asserted Patents by reference, it is known in the art that light

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image data may be stored in vector-system format or metafiles rather than as pixels. Further, dependent Claim 5 of the '822 Patent, for example, specifies when light-source data is associated with pixels, suggesting that light image data is not inherently pixels. Finally, neither Plaintiffs nor their expert witness characterized "light image data" as necessarily pixel data during the '822 Patent IPR. Specifically, the IPR statements that Defendants rely on are made in the context of explaining the background of the technology or to note a distinction between the rendering method of the '822 Patent and that of a prior art reference, rather than to distinguish the claims from prior art based on light image data necessarily being pixels. In fact, Plaintiffs acknowledged that the distinguished prior art reference in fact disclosed using pixel data. (Dkt. No. 107 at 25–32.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent col.7 ll.59–61, col.11 ll.51–61; '822 Patent IPR Laub Decl. ¶¶ 56–57 (Defendants' Ex. L, Dkt. No. 99-1 at 210–24), Patent Owner Preliminary Response at 5–7, 11–12 (Defendants' Ex. H, Dkt. No. 99-1 at 181–91; Plaintiffs' Ex. K, Dkt. No. 107-7), Hr'g Tr. at 50:9–11 (Plaintiffs' Ex. L, Dkt. No. 107-8), *'822 Patent IPR Final* at 16–17 (Plaintiffs' Ex. M, Dkt. No. 107-9); *Foley* at 9–12, 844, 849 (Plaintiffs' Exs. F–H, Dkt. Nos. 107-2, 107-3, 107-4).

Defendants respond: In the EA Case, the EA Court did not have the benefit of the record of the Inter Partes Reviews when construing "light image data." Here, the Court must construe the term in the full light of that record and hold Plaintiffs to statements made to secure patentability of the Asserted Patents. Further, the Court here should reconsider the *EA Construction* characterization of the disclosure at column 11, line 51–61 of the '822 Patent. Specifically, rather than supporting that light image data may be polygons rather than pixels, it states the light image may be rendered for each polygon. This comports with light image data being pixels. (Dkt. No. 106 at 23–27.)

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Defendants cite further extrinsic evidence to support their position: EA Case Ferraro Decl. ¶ 17 (Defendants' Ex. E, Dkt. No. 99-1 at 107–18).

Analysis

The issue in dispute is whether "light image data" is necessarily in the form of pixels. Light image data is necessarily two-dimensional data that is distinct from depth data, but this does not mean that it is necessarily pixel values.

The Court generally agrees with the assessment of "light image data" set forth in the *EA Construction*. 2016 WL 5415429, at *10–11. Specifically, the Asserted Patents provide that "light image data" does not necessarily come in array or matrix form:

> With this in mind, FIG. 3 is a block diagram depicting exemplary arrangements of modeling data as used to render lighting and shadows, in accordance with certain embodiments of the present invention. For convenience, the various rendered data in FIG. 3 is illustrated as being logically stored in a plurality of 2D matrices or data bases 50 and 51A-G, each having an X axis and a Y axis. ***Preferably***, and in this example, the ***X and Y axis correspond*** an exemplary output device 56 having a screen that ***displays X by Y number of pixels*** when provided corresponding red-green-blue (RGB) pixel data values. ***Those skilled in the art will recognize that other conventions and/or arrangements can also be used for storing and manipulating the data***.

'822 Patent col.6 l.58 – col.7 l.3 (emphasis added). In light of this disclosure, and with an understanding of "pixels" as "arrays of data corresponding to display device pixels," the EA Court held that "light image data" is not limited to "pixels." 2016 WL 5415429, at *11 ("'Light image data' is not necessarily in pixel (or array) form."), *15 ("As set forth in the above section on 'light image data' the Court does not understand that scene-view image data is necessarily in the form of pixels (or arrays of data corresponding to display-device pixels)"). Importantly, the EA Court did not hold that light image data may be other than 2D data. Indeed, the EA Court noted that the lighting data (which is defined by the light image data) represents a 2D view:

> That said, the Court understands that the "modeled point within said scene" refers to a point on a modeled 3D object within the simulated scene. But this does not

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mean that the "comparing" step necessarily is comparing 3D data. Rather, the claim language expresses that *the comparison is between observer data and lighting data, both of which represent 2D views of the scene*.

Id. at *15 (emphasis added). The Court here agrees with the *EA Construction* to the extent that "light image data" is 2D data that is not necessarily limited to "arrays of data corresponding to display-device pixels." *Id*.

In the '822 Patent IPR, Plaintiffs represented the invention as operating at the "pixel level," but the Court does not understand this to equate "light image data" with arrays of data corresponding to display-device pixels. For instance, in the '822 Patent IPR, Plaintiffs stated that "*the '822 patent provides* techniques that operate at a pixel level on fully rendered images in two-dimensional space, in contrast to scan-converted three-dimensional polygons." Preliminary Response at 1–2, IPR2016-00928, paper 6 (July 26, 2016) (emphasis added). Operating at the 2D level was presented to the PTAB as a point of novelty:

> To finally provide the rendered camera data that the '822 patent initially provides, Segal must perform scan-conversion of the 3D scene at every pass to incrementally render the camera data. As previously described, this scan conversion produces a series of screen points for every polygon in the scene. *In contrast*, the '822 patent performs its lighting and shadowing on the X by Y array of pixels illustrated in Figure 3 of the '822 patent.

Id. at 11 (emphasis added). These statements are characterizations of the invention, not of an exemplary embodiment. That said, Plaintiffs also represented to the PTAB that "light image data" is "data representing the light emitted by each of the plurality of light sources." *Id*. at 17. Further, construing "light image data" as "pixel data" may suggest a correspondence between the display pixels and the "light image data." Indeed, Defendants suggested this at the hearing. Plaintiffs did not characterize "pixels" in this way in the '822 Patent IPR nor did the patentee characterize pixels this way in the Asserted Patents. In fact, the patents teach that "light image data" does not necessarily correspond to the display. *See, e.g.,* '822 Patent col.3 ll.24–35 (describing that the

observer data, modified by the lighting data "if a modeled point within the scene is illuminated," is displayed, rather than the lighting data itself). This suggests that "light image data" is not necessarily limited to pixels. Taken in its entirety and in context, the Preliminary Response in the '822 Patent IPR does not present a clear and unmistakable disclaimer of 2D data that are not pixels.

Accordingly, the Court construes "light image data" as follows:

- "light image data" means "for each of the plurality of light sources, 2D data representing the light emitted by the light source to illuminate the scene as viewed from the light source's perspective."

E.   "storing at least a portion of said light image data associated with said point and said light source" and "at least a portion of"

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"storing at least a portion of said light image data associated with said point and said light source" - '822 Patent Claim 1 - '488 Patent Claims 1, 11, 27	"at least a portion of" has its plain and ordinary meaning	storing all or a subset of said light image data associated with said point and said light source
"at least a portion of" - '822 Patent Claim 1 - '488 Patent Claims 1, 11, 27	plain and ordinary meaning	all or a subset of

Because the parties' arguments and proposed constructions with respect to these terms are related, the Court addresses the terms together.

The Parties' Positions

Plaintiffs submit: By limiting "at least a portion of" to "all or a subset of" Defendants' proposed construction threatens to improperly exclude a portion of the light image data that is a fractional portion of that data. (Dkt. No. 101 at 26–28.)

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Defendants submit: The term "at least a portion of" needs to be construed to clarify that it does not encompass just any numerical derivative of the data. This comports with the reasoning expressed in the *EA Construction*, where the EA Court held that it "does not understand that the plain and ordinary meaning of 'at least of portion of' data encompasses any number that is a fractional component of one number within the set." This also comports with Plaintiffs' position in the EA Case, where Plaintiffs argued that the plain meaning of "at least of portion of" is "at least some but potentially all of." Finally, this comports with the disclosure of the Asserted Patents, which describes portions of data as subsets of the data rather than derivatives of the data. Ultimately, "storing data that are the result of performing mathematical operations on values identified as 'light image data' in the 'providing' step are not the same as storing 'at least a portion of' 'light image data.'" (Dkt. No. 99 at 41–45.)

In addition to the claims themselves, Defendants cite the following intrinsic and extrinsic evidence to support their position: Intrinsic evidence: '822 Patent fig.4, col.4 ll.34–35, col.7 ll.15–19, col.8 ll.45–60, col.8 ll.63–67, col.9 ll.1–12. Extrinsic evidence: EA Case Ferraro Decl. ¶ 21 (Defendants' Ex. E, Dkt. No. 99-1 at 107–18).

Plaintiffs respond: The plain meaning of "at least a portion of" data does not exclude fractional comparisons of the data, does not encompass a portion that does not correspond to the data, and does not exclude a portion that corresponds to the data but has also been altered or modified. (Dkt. No. 107 at 36–38.)

Defendants respond: As described in the Asserted Patents, "at least a portion of" data does not encompass "for example, dividing a number provided as light image data by another number and storing the result as being 'a portion of' any of the data." Specifically, "[p]erforming arbitrary

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mathematical operations on the provided data and storing the result is not equivalent to storing 'at least a portion of' that data." (Dkt. No. 106 at 31–33.)

Defendants cite further **intrinsic evidence** to support their position: '822 Patent col.7 ll.46–48, col.8 l.39 – col.9 l.12.

Analysis

The issue in dispute distills to whether "at least a portion of" data necessarily refers to at least a subset of the data. As the Court understands Defendants' use of "subset," it does not. Specifically, "at least a portion of [data]" does not necessarily exclude transformed data, as Defendants contend.

The Court rejects Defendants' proposed construction that essentially requires the form of a portion of data to be the same as the form of the data. Indeed, this form-preserving limitation expressed in Defendants' argument threatens to exclude both exemplary and claimed embodiments. For instance, the claims recite "storing at least a portion of said light image data … in a light accumulation buffer." *See, e.g.*, '822 Patent col.12 ll.15–18. As explained in the Asserted Patents, the portion of light image data may be stored in the accumulation buffer by numerically adding it to values already in the accumulation buffer. *See, e.g., id*. at col.9 ll.42 ("ACCUM (SPx, SPy)+=LIGHT IMAGE (LPx, LPy)"). Indeed, this is a main aspect of the invention—to *accumulate* light on illuminated modeled points. Thus, the portion of data that is stored is mathematically transformed. Said differently, mathematically transforming light image data and storing the result is exactly what the patents disclose. This is encompassed by the claims.

Accordingly, the Court determines that "storing at least a portion of said light image data associated with said point and said light source" does not need to be construed apart from the construction of "at least a portion of." The Court finds that any interpretation of "at least a portion of" as requiring storing an untransformed subset of data would be inconsistent with the plain and

ordinary meaning of the term. Therefore, the Court rejects Defendants' "all or a subset of"

limitation (as that proposed limitation is explained by Defendants), and determines that "at least a

portion of" has its plain and ordinary meaning without the need for further construction.

F.   "light accumulation buffer"

Disputed Term	Plaintiffs' Proposed Construction	Defendants' Proposed Construction
"light accumulation buffer" • '822 Patent Claim 1 • '488 Patent Claims 1, 27	memory for storing the light image data for cumulative light falling on a region in the observer image corresponding to a modeled point	memory for storing the light image data for cumulative light falling on each illuminated region in the observer image corresponding to a modeled point

The Parties' Positions

Plaintiffs submit: The Asserted Patents provide for storing only the portion of the scene that

is changed, rather than storing "each illuminated region" as Defendants propose. In the EA Case,

the EA Court reached this same conclusion when it held that the light data stored in the light

accumulation buffer "may comprise data for only those pixels that change from frame to frame,

and not all pixels must change." (Dkt. No. 101 at 28–31.)

In addition to the claims themselves, Plaintiffs cite the following **intrinsic evidence** to support

their position: '822 Patent col.7 ll.47–49, col.8 ll.57–67, col.11 ll.15–27, col.11 ll.58–59.

Defendants submit: The *EA Construction* did not address the dispute between the parties here;

namely, whether the light accumulation buffer necessarily stores data for each illuminated region.

As described in the Asserted Patents, the light accumulation buffer accumulates light for each lit

pixel in the scene. It thus stores light image data for each illuminated region. This is how Plaintiffs'

expert in the '822 Patent IPR characterized the light accumulation buffer to the PTAB and this is

how Plaintiffs presented the light accumulation buffer to the EA Court in the EA Case. (Dkt. No. 99 at 38–41.)

In addition to the claims themselves, Defendants cite the following intrinsic evidence to support their position: '822 Patent figs.3–4, col.7 ll.4–6, col.7 ll.15–53, col.7 ll.46–52, col.8 l.39 – col. 9 l.5, col.9 ll.8–12; '822 Patent IPR Laub Decl. ¶¶ 62–63 (Defendants' Ex. L, Dkt. No. 99-1 at 210–24).

Plaintiffs respond: Defendants' proposed construction would require processing of every region in a scene for every frame in order to store each region, which contradicts the Asserted Patents' teachings that only regions that change from frame to frame need to be processed and the lighting results stored. (Dkt. No. 107 at 32–36.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent col.3 ll.15–19, col.11 ll.18–30, col.8 ll.56–60.

Defendants respond: As explained in the patents, the purpose of the light accumulation buffer is to accumulate "light from all the light sources that illuminate each pixel in the observer image." For pixels that do not change from frame to frame, the data in the buffer does not change and does not need to be recomputed, but it is still stored. (Dkt. No. 106 at 28–31.)

Defendants cite further intrinsic evidence to support their position: '822 Patent col.9 ll.3–12; *'822 Patent IPR Institution* at 12–13 (Defendants' Ex. Q, Dkt. No. 106-1 at 9–16).

<u>Analysis</u>

The issue in dispute is whether the light accumulation buffer necessarily stores data for each illuminated region in a scene. While the claims plainly require that the accumulation buffer stores certain light data "for each of [a] plurality of light sources," they require storage of data for only

"an" illuminated modeled point, not all points. That is, the claims do not require (though they encompass) accumulating light for every modeled point in the scene.

The claims require processing of each of a plurality of light sources, but do not expressly require processing of each modeled point in a scene. For example, Claim 1 of the '822 Patent, produced and annotated here, recites that "for each" light source, "determine if *a* modeled point … is illuminated … and storing at least a portion of said light image data … in a light accumulation buffer." The claim does not express that light is stored in the accumulation buffer for each illuminated point. The lack of an express for-each-illuminated-point limitation is meaningful, especially considering the claim

> **'822 Patent**
>
> **1**. A shadow rendering method for use in a computer system, the method comprising the steps of:
>
> providing observer data of a simulated multi-dimensional scene;
>
> providing lighting data associated with a plurality of simulated light sources arranged to illuminate said scene, said lighting data including light image data;
>
> *for each of said plurality of light sources*, comparing at least a portion of said observer data with at least a portion of said lighting data to *determine if a modeled point within said scene is illuminated* by said light source and *storing at least a portion of said light image data associated with said point* and said light source in a light accumulation buffer; and then combining at least a portion of said light accumulation buffer with said observer data; and displaying resulting image data to a computer screen.

expressly requires that light is stored for each light source associated with an illuminated point. Further, the Asserted Patents specifically teach that the accumulation buffer may not store lighting data for all portions of a scene. For example, the patents provide that only a partial view needs to be processed to provide lighting and shadow rendering:

> RENDER EACH VIEW (*PARTIAL* IF THE LIGHT IS STATIONARY)
> *CLEAR ACCUM BUFFER*
> FOR EACH LIGHT SOURCE …
>   FOR EACH PIXEL IN CAMERA IMAGE SPxSPy…
>   TRANSFORM EACH SP TO A LP {LIGHT PIXEL} USING EITHER:
>   TRANSFORM LOOK-UP TABLE,

> OR
> MATRIX TRANSFORMATION CALCULATION
> IF LP2 <LIGHT DEPTH (LPx, LPy) THEN
> ACCUM (SPx, SPy)+=LIGHT IMAGE (LPx, LPy)
> FOR EACH PIXEL IN CAMERA IMAGE …
> CAMERA IMAGE (SPx, SPy)*=ACCUM (SPx, SPy)

'822 Patent col.9 ll.31–44 (emphasis added). That only partial views are rendered but the accumulation buffer is cleared for each rendering pass ("CLEAR ACCUM BUFFER") indicates that the accumulation buffer does not necessarily store accumulated light for all points in the scene. This is further explained with reference to an exemplary application of the process:

> With regard to man 208 as depicted in depth image 220, the depth image 220 has been further processed in this example to include data relating to the depth of man 208. This can be accomplished, for example, by comparing previous frames and completing new transform calculations for pixels that have changed and that are in the depth image for the light source. Thus, for example, from the previous frame, man 208 may have moved slightly (e.g., in response to inputs from the user). A portion of the pixels are identified as having changed from the previous frame. The portion of the pixels that changed are then transformed and processed to generate new modified light depth data 228. In this manner, *only those portions of the scene that change need to be reprocessed*.

Id. at col.11 ll.14–27 (emphasis added). Thus, the light accumulation buffer does not necessarily store data for every illuminated point, or region, in the scene.

Finally, the parties each propose "corresponding to *a* modeled point" in their constructions, but "corresponding to *the* modeled point" better reflects the surrounding claim language, which indicates that the information that is stored in the accumulation buffer is light image data associated with the modeled point determined to be illuminated by the light source. *See, e.g.*, '822 Patent col.12 ll.11–18 (Claim 1, reciting "determine if a modeled point within said scene is illuminated by said light source and *storing* at least a portion of said *light image data associated with said point*" (emphasis added)).

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Accordingly, the Court construes "light accumulation buffer" as follows:

- "light accumulation buffer" means "memory for storing the light image data for cumulative light falling on a region in the observer image corresponding to the modeled point."

G.   "light accumulation buffer portion" and "frame buffer portion"

Disputed Term	Plaintiffs' Proposed Construction	Microsoft's Proposed Construction[12]
"light accumulation buffer portion" • '488 Patent Claim 11	plain and ordinary meaning alternatively: • a portion of the memory for storing at least the light image data for cumulative light falling on a region in the observer image corresponding to a modeled point	region of memory distinct from the frame buffer portion for storing the light image data for cumulative light falling on each illuminated region in the observer image corresponding to a modeled point
"frame buffer portion" • '488 Patent Claim 11	plain and ordinary meaning alternatively: • a portion of the memory for storing at least the resulting data from combining at least a portion of the light accumulation buffer with the observer data	region of memory distinct from the light accumulation buffer portion for storing RGB data of the final rendered 2D image of the scene

The Parties' Positions

Plaintiffs submit: In the *EA Construction*, the EA Court rejected Plaintiffs' previous position that the frame buffer and light accumulation buffer are necessarily distinct memories. For the same reasons expressed in the *EA Construction*, the Court here should reject Defendants' position that

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[12] These terms apply only to the Microsoft Case. (Dkt. No. 109-1 at 4 n.1.)

the frame buffer portion and light accumulation buffer portion are necessarily distinct regions of memory. Further, "frame buffer" is a well-understood term of art that refers to "memory that stores data produced by the rendering system in response to a rendering process." The term is used in the Asserted Patents according to this customary meaning to refer to the memory that stores the data resulting from combining a portion of the light buffer data with the observer data. It does not necessarily store "RGB data of the final rendered 2D image," as Defendants propose. (Dkt. No. 101 at 32–35.)

In addition to the claims themselves, Plaintiffs cite the following intrinsic evidence to support their position: '822 Patent col.4 ll.19–21.

Defendants submit: The Asserted Patents consistently describe the light accumulation buffer and the frame buffer as two distinct memories and Claim 11 of the '488 Patent expresses this by requiring a memory that includes a light accumulation buffer portion and a frame buffer portion. There are two distinct portions of memory. This is how Plaintiffs characterized the memory portions in the '822 Patent IPR. This is a different issue than addressed in the *EA Construction*. That construction addressed only whether the light accumulation buffer and the frame buffer were necessarily distinct structures, not whether two portions of memory were necessarily distinct. Further, the light accumulation buffer portion necessarily stores a single type of data, namely, light image data for each illuminated region, and nothing else. Finally, and according to its customary meaning in the art, the frame buffer portion necessarily stores the RGB data of the final rendered 2D image of the scene. (Dkt. No. 99 at 45–51.)

In addition to the claims themselves, Defendants cite the following intrinsic evidence to support their position: '822 Patent fig.3, col.2 ll.49–50, col.3 l.28, col.3 ll.30–31, col.3 l.33, col.4 ll.15–20, col.5 ll.8–9, col.5 l.66 – col.6 l.5, col.7 ll.56–59, col.8 ll.58–67, col.9 ll.12–22, col.10

l.18, col.11 l.13, col.11 l.22, col.11 ll.37–40; '822 Patent IPR Patent Owner Response at 8 (Defendants' Ex. I, Dkt. No. 99-1 at 193–98), Hrn'g Tr. at 70 (Defendants' Ex. J, Dkt. No. 99-1 at 199–204), Laub Decl. ¶ 66 (Defendants' Ex. L, Dkt. No. 99-1 at 210–24), Laub Dep.[13] 206–07 (Defendants' Ex. K, Dkt. No. 99-1 at 205–09), Randel Decl.[14] ¶ 23 (Defendants' Ex. M, Dkt. No. 99-1 at 225–27).

Plaintiffs respond: The frame buffer portion and light accumulation buffer portion are not necessarily physically distinct. Rather, their distinction is functional. For the reasons stated with respect to the "light accumulation buffer" term, the light accumulation buffer portion does not necessarily store each illuminated region. With respect to what the frame buffer portion stores, the claim states what is stored; namely, the "resulting image data" from "combining at least a portion of said light accumulation buffer with said observer data." While the parties agree that "observer data" includes color data, the color data is not necessarily RGB data. In fact, dependent Claim 13 separately requires RGB data in the observer data, suggesting that observer data—and the frame buffer portion—do not necessarily include RGB data. Finally, as noted in *Foley*, the customary meaning of "frame buffer" is not limited to storing the "final rendered 2D image of the scene" but may, e.g., store intermediate results. (Dkt. No. 107 at 39–45.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent col.4 l.17, col.7 ll.58–59, col.9 ll.13–22, col.11 ll.37–40; *Foley* at 887 (Plaintiff's Ex. I, Dkt. No. 107-5).

Defendants respond: The Asserted Patents describe the frame buffer and light accumulation buffer as distinct regions in memory and Claim 11 recites two "portions" of memory, the frame buffer portion and the light accumulation buffer portion. Thus, these two portions are distinct.

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[13] Deposition of Leonard Laub, IPR2016-00928, Ex. 1024.
[14] Declaration of Mark R. Randel In Support of Patent Owner's Response to Petition for Inter Partes Review, IPR2016-00928, Ex. 2051.

Further, the Asserted Patents describe the frame buffer as holding "RGB data of the final rendered 2D image." Thus, the frame buffer portion necessarily holds this data, which is generated at the final step, "after the light accumulation buffer has been combined with the observer data." (Dkt. No. 106 at 34–36.)

Defendants cite further intrinsic evidence to support their position: '822 Patent col.7 ll.43–48.

<u>Analysis</u>

There are three issues in dispute. First, whether the memory portions are necessarily distinct. They are, but the distinction is not necessarily physical. Second, whether the light accumulation buffer portion necessarily is for storing the light image data for cumulative light falling on each illuminated region. As explained in the above section on "light accumulation buffer," the claims do not require storing data for each illuminated region. Third, whether the "frame buffer portion" necessarily is for storing "RGB data of the final rendered 2D image of the scene." It is not.

To begin, the Court notes that the *EA Construction* provided that "the patents expressly teach that a single data structure may serve more than one function. The Court discerns no contrary teaching that would require the frame buffer and light accumulation buffer be different data structures, logically or physically." *EA Construction*, 2016 WL 5415429, at *15. The PTAB reached a similar conclusion: "After consideration of Patent Owner's contentions and evidence, without further clarification, we are not persuaded that adding the requirement that the accumulation buffer be 'a region…separate and distinct' is consistent with the plain and ordinary meaning of the term." *'822 Patent IPR Institution*, slip op. at 14. Notably, the PTAB identified a distinction between "light accumulation buffer" and "light accumulation buffer portion and a frame buffer portion" as used in the claims:

> We further note that claim 11 recites "said memory further including a light accumulation buffer portion and a frame buffer portion." To the extent that Patent

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> Owner contends that "a region…separate and distinct" must be more separate and distinct than a light accumulation portion and a frame portion, on this record, Patent Owner's contention is not consistent with the above-referenced recitation in claim 11. Claims 1 and 39 are broader because they do not recite "frame buffer" or "frame buffer portion."

Id. [15] The Court here similarly sees a distinction between "light accumulation buffer" as used in, e.g., Claim 1 of the '488 Patent, which was before the EA Court, and "light accumulation buffer portion" as used in Claim 11 of the '488 Patent, which is currently before the Court.

The two portions of the memory recited in Claim 11, namely, the "light accumulation buffer portion" and the "frame buffer portion," are distinct portions of memory. Claim 11 provides: "memory further including a light accumulation buffer portion and a frame buffer portion." '488 Patent col.13 ll.22–24. The simple fact that these two portions are separately listed in the claims suggests that they are distinct structures. *See Becton, Dickinson & Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1254 (Fed. Cir. 2010) ("Where a claim lists elements separately, the clear implication of the claim language is that those elements are distinct components of the patented invention." (quotation and modification marks omitted)). While the Court here agrees with the EA Court and the PTAB that the description of the invention does not mandate that the "light accumulation buffer" is inherently a distinct structure in itself, nothing in the Asserted Patents suggests reading "memory further including a light accumulation buffer portion and a frame buffer portion" other than according to the clear implication that the memory portions are distinct.

The memory portions are not necessarily physically distinct regions. To begin, it is not clear how Defendants are using "region" in their proposed construction and the term does not appear in the Asserted Patents. Plaintiffs' argument that Defendants' construction may require separate memory devices contrary to the patents' disclosure of a single memory device (Dkt. No. 107 at

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[15] The "light accumulation buffer portion" and "frame buffer portion" limitations appear in Claim 11 of the '822 Patent in addition to Claim 11 of the '488 Patent, which is before the Court here.

40–41) suggests that changing "portion" to "region" may not resolve the dispute but rather just shift the dispute. Further, the Asserted Patents specifically describe that data structures may be logical. *See, e.g.*, '822 Patent col.6 ll.61–63 ("the various rendered data in FIG. 3 is illustrated as being logically stored in a plurality of 2D matrices or data bases 50"). Indeed, Defendants cite the Figure 3 data embodiments as evidence that the accumulation buffer portion and frame buffer portions are distinct. (*See, e.g.*, Dkt. No. 99 at 46–47.) Ultimately, the patents do not exclude from the scope of "light accumulation buffer portion" or "frame buffer portion" buffers that are functionally distinct from each other but do not occupy distinct regions in the same physical memory device.

Finally, the claim sets forth what the "frame buffer portion" includes: "combining at least a portion of said light accumulation buffer with said observer data, and storing resulting image data in said frame buffer." '488 Patent col.13 ll.33–35. Here, the Court understands "said frame buffer" to refer to the "frame buffer portion" of memory recited earlier in the claim. Thus, the frame buffer portion expressly includes the image data that results from combining a portion of the light accumulation buffer with the observer data. The Court is not persuaded by Defendants' argument that a "frame buffer" inherently includes the data depicted in the Figure 3 embodiment, namely, "RGB data of the final rendered 2D image of scene 10." (*See* Dkt. No. 99 at 51 (quoting '822 Patent col.7 ll.56–58)). Specifically, the Figure 3 data structures are expressly exemplary rather than definitional. '822 Patent col.6 ll.58–61 ("FIG. 3 is a block diagram depicting exemplary arrangements of modeling data as used to render lighting and shadows, in accordance with certain embodiments of the present invention."). The claim expressly recites "outputting at least a portion of said image data in said frame buffer to said display screen," but based on the evidence of record

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the Court does not understand that this requires RGB data of the final rendered 2D image of the

scene, as Defendants contend.

Accordingly, the Court construes these terms as follows:

- "light accumulation buffer portion" means "portion of the memory that (1) is
  physically or logically distinct from the frame buffer portion and (2) is for storing
  the light image data for cumulative light falling on a region in the observer image
  corresponding to the modeled point"; and

- "frame buffer portion" means "portion of the memory that (1) is physically or
  logically distinct from the frame buffer portion and (2) is for storing the resulting
  data from combining at least a portion of the light accumulation buffer with the
  observer data."

H.   "at least one processor coupled to said memory and said output and operatively configured to"

Disputed Term	Plaintiffs' Proposed Construction	Microsoft's Proposed Construction[16]
"at least one processor coupled to said memory and said output and operatively configured to" • '488 Patent Claim 11	at least one processor coupled to said memory and said output that is configured to operate in accordance with at least one computer application having computer instructions therein	at least one processor coupled to said memory and said output and programmed with executable instructions that instruct the processor to

The Parties' Positions

Plaintiffs submit: The '488 Patent explains what it means for a processor to be "operatively

configured to" perform functions; namely, the processor "is configured to operate in accordance

with a least one computer application having computer instructions thereon" (quoting '488

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[16] This term applies only to the Microsoft Case. (Dkt. No. 109-1 at 4 n.1.)

Patent[17] col.5 ll.56–59). The processor of Claim 11 receives from a computer application the data and computer instructions to carry out the recited functions. Thus, "a POSITA would understand Claim 11 to describe a processor that operates in conjunction with a computer application that provides data, and that this processor, carries out the instructions from the computer application, serving as an intermediary between the computer application and the graphics system or arrangement." (Dkt. No. 101 at 35–40.)

In addition to the claims themselves, Plaintiffs cite the following intrinsic evidence to support their position: '488 Patent fig.4, col.3 l.22, col.4 ll.41–56, col.5 ll.56–59, col.8 ll.40–42; *Foley* at 17–22 (Plaintiffs' Ex. D, Dkt. No. 101-4).

Defendants submit: Claim 11 requires a processor that is actually programmed with executable instructions that instruct the processor to perform the claimed functions. As described in the Asserted Patents, a processor is configured to operate when it has been programmed with an application. This is the plain meaning of "configured to," which denotes that the system is already in the state to perform the functions. This is more than mere capability to be configured to perform the functions. (Dkt. No. 99 at 52–55.)

In addition to the claims themselves, Defendants cite the following intrinsic evidence to support their position: '822 Patent figs.1, 4, col.5 ll.19–22, col.5 ll.54–57, col.9 ll.28–44.

Plaintiffs respond: The Asserted Patents explain that a processor is operatively configured to perform the functions when it operates in accordance with an application having the instructions to instruct the processor to perform the functions. This does not require that the processor be

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[17] Plaintiffs ostensibly cite the '822 Patent but provide pin cites for material that correspond to the '488 Patent. Accordingly, the Court understands that while the Asserted Patents share the same disclosure, Plaintiffs actually meant to cite the '488 Patent in this section.

preprogrammed with executable instructions for performing the functions. (Dkt. No. 107 at 45–48.)

Plaintiffs cite further intrinsic evidence to support their position: '822 Patent col.4 ll.39–40, col.4 ll.50–65, col.5 ll.54–57; *Foley* at 866–67 (Plaintiffs' Ex. J, Dkt. No. 107-6).

Defendants respond: A processor that must have a software loaded onto it in order to perform the recited functions is configurable to perform the functions, but is not operatively configured to perform the functions. (Dkt. No. 106 at 36–40.)

Analysis

The issue in dispute is whether the processor that is "operatively configured to" perform the recited functions in Claim 11 is programmed with instructions to perform the functions. The Court understands that the processor is programmed or otherwise equipped with hardware or software to perform the recited functions.

The phrase "operatively configured to [perform functions]" denotes more than the mere capability to be configured that Plaintiffs suggest. It denotes that the processor is actually configured to perform the functions rather than merely configured to receive instructions that would in turn configure the processor to perform the functions. A processor embodiment is described in the Asserted Patents: "Computer system 40 includes at least one processor 42 that is configured to operate in accordance with at least one computer application 44 having computer instructions therein." '822 Patent col.5 ll.54–57. The computer system is depicted in, and described with reference to, Figure 1 (produced and annotated here). The application (44,

'822 Patent Figure 1

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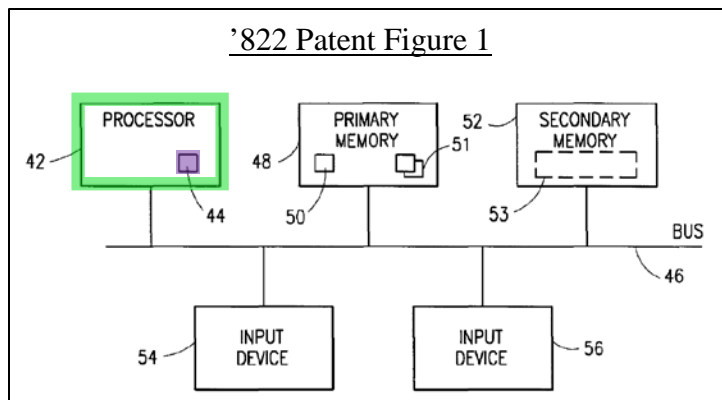
purple) is depicted on or as part of the processor (42, green). This suggests that the processor is "configured to operate in accordance with" the application by reason of the application being installed or loaded on the processor and controlling the processor to perform the functions. Notably, the application (44) is not depicted on some second processor communicating with the processor (42) to provide instructions and data to cause the processor (42) to perform the functions, as Plaintiffs appear to suggest. Further, the Claim language at issue is "at least one processor coupled to said memory and said output and operatively configured to [perform functions]." There is no "application" mentioned in the claim that somehow provides instructions that would then configure the processor to perform the functions.

The plain meaning of the "operatively configured to …" claim language is that the processor is structured (configured) to produce the intended effect in operation, without the need for further structuring. *See Innova/Pure Water, Inc. v. Safari Water Filtration Sys.*, 381 F.3d 1111, 1118 (Fed. Cir. 2004) (stating the ordinary and customary meaning of "operatively connected [components]" "requires the . . . linking together of the [components] to produce the intended or proper effect … i.e., the designated functions"); *Aspex Eyewear, Inc. v. Marchon Eyewear, Inc.*, 672 F.3d 1335, 1349 (Fed. Cir. 2012) (noting "configured to" claim language is distinct form "capable of" or "suitable for," and that "members … configured to accomplish [a] specified objective" requires more than "simply that they can be made to serve that purpose"). The Court agrees with Defendants that this limitation is similar to the "memory for [performing a function]" limitation in *Typhoon Touch Techs. v. Dell, Inc.*, 659 F.3d 1376 (Fed. Cir. 2011) and the "central processing unit (CPU) capable of [performing functions]" limitation in *Nazomi Communs., Inc. v. Nokia Corp.*, 739 F.3d 1339 (Fed. Cir. 2014). In *Typhoon Touch*, the "memory for …" limitation required "that the memory is actually programmed or configured to" perform the function as distinct from memory

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in a state in which it "might later be modified to perform that function." 659 F.3d at 1380–81. In *Nazomi*, the "(CPU) capable of …" limitation required a CPU comprising a "combination of hardware and software capable of practicing" the functions as distinct from a CPU in a state in which it was "programmable" to perform the functions or in which "it could be combined with software" to perform the functions. 739 F.3d at 1344–45. *See also*, *Sipco, LLC v. Abb, Inc.*, No. 6:11-CV-0048-LED-JDL, 2012 WL 3112302, at *11 (E.D. Tex. July 30, 2012) (noting that construing "configured to" perform a function as "may be configured [to]" perform a function "would eliminate any meaningful limits to the claims").

Ultimately, the plain meaning of the "operatively configured to" claim language is that the processor is structurally in a state to actually perform the recited functions as opposed to being in a state from which it may receive instructions which in turn configure the processor to perform the functions. As set forth in the Asserted Patents, the "improved methods and arrangements of the present invention can be implemented in hardware and/or software." '822 Patent col.4 ll.39–40; *see also, id*. at col.9 ll.28–30 ("the following exemplary pseudocode can be implemented in either hardware o[r] software"). Thus, the processor is "operatively configured to" perform the functions when it includes the hardware or software that places it in a state to actually perform the functions.

Accordingly, the Court construes this term as follows:

- "at least one processor coupled to said memory and said output and operatively configured to" means "at least one processor coupled to said memory and said output and actually programmed or equipped with hardware or software to."

V.   CONCLUSION

The Court adopts the constructions set forth above, as summarized in the following table. The parties are **ORDERED** that they may not refer, directly or indirectly, to each other's claim-

construction positions in the presence of the jury. Likewise, the parties are **ORDERED** to refrain from mentioning any portion of this opinion, other than the actual definitions adopted by the Court, in the presence of the jury. Any reference to claim-construction proceedings is limited to informing the jury of the definitions adopted by the Court.

Within thirty (30) days of the issuance of this Memorandum Opinion and Order, the parties are hereby **ORDERED**, in good faith, to mediate this case with the designated mediator in this case. As a part of such mediation, each party shall appear by counsel (with lead and local counsel present and participating) and by at least one corporate officer possessing sufficient authority and control to unilaterally make binding decisions for the corporation adequate to address any good faith offer or counteroffer of settlement that might arise during such mediation. Failure to do so shall be deemed by the Court as a failure to mediate in good faith and may subject that party to such sanctions as the Court deems appropriate.

Group	Term	Construction
A	"A shadow rendering method for use in a computer system" • '822 Patent Claim 1	the preamble is not limiting
	"A shadow rendering method" • '488 Patent Claim 1	the preamble is not limiting
	"An arrangement configured to render shadows in a simulated multidimensional scene" • '488 Patent Claim 11	the preamble is not limiting
B	"determine if a modeled point within said scene is illuminated by said light source" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	determine if a point on a modeled object within said scene is illuminated by said light source

Group	Term	Construction
C	"providing lighting data associated with a plurality of simulated light sources arranged to illuminate said scene, said lighting data including light image data" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	plain and ordinary meaning, subject to construction of "light image data"
D	"light image data" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	for each of the plurality of light sources, 2D data representing the light emitted by the light source to illuminate the scene as viewed from the light source's perspective
E	"storing at least a portion of said light image data associated with said point and said light source" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	plain and ordinary meaning
E	"at least a portion of" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	plain and ordinary meaning
F	"light accumulation buffer" • '822 Patent Claim 1 • '488 Patent Claims 1, 27	memory for storing the light image data for cumulative light falling on a region in the observer image corresponding to the modeled point
G	"light accumulation buffer portion" • '488 Patent Claim 11	portion of the memory that (1) is physically or logically distinct from the frame buffer portion and (2) is for storing the light image data for cumulative light falling on a region in the observer image corresponding to the modeled point

Group	Term	Construction
	"frame buffer portion" • '488 Patent Claim 11	portion of the memory that (1) is physically or logically distinct from the frame buffer portion and (2) is for storing the resulting data from combining at least a portion of the light accumulation buffer with the observer data
H	"at least one processor coupled to said memory and said output and operatively configured to" • '488 Patent Claim 11	at least one processor coupled to said memory and said output and actually programmed or equipped with hardware or software to
AGREED	"providing" • '822 Patent Claim 1 • '488 Patent Claims 1, 27	making available
	"observer data of a simulated multi-dimensional scene" • '822 Patent Claim 1 • '488 Patent Claims 1, 27	data representing at least the color of objects in a simulated multi-dimensional scene as viewed from an observer's perspective
	"observer data associated with a simulated multi-dimensional scene" • '488 Patent Claim 11	
	"a modeled point within said scene" • '822 Patent Claims 1, 6 • '488 Patent Claims 1, 11, 27	a point on a modeled object within said scene
	order of the comparing, storing, and combining steps • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	the comparing and storing steps are completed before beginning the combining step
	"displaying resulting image data to a computer screen" • '822 Patent Claim 1	displaying the image data resulting from combining at least a portion of the light accumulation buffer with the observer data on a computer screen

Group	Term	Construction
	"outputting resulting image data" • '488 Patent Claims 1, 27	outputting for presentation to a user the image data resulting from combining at least a portion of the light accumulation buffer with the observer data
	"combining at least a portion of said light accumulation buffer with said observer data" • '822 Patent Claim 1 • '488 Patent Claims 1, 11, 27	combining at least a portion of the data in the light accumulation buffer with said observer data • subject to the above constructions of "at least a portion of," "light accumulation buffer," and "observer data …"
	"A computer-readable medium carrying at least one set of computer instructions configured to cause at least one processor to operatively render simulated shadows in a multidimensional simulated scene" • '488 Patent Claim 27	the preamble is limiting

So ORDERED and SIGNED this 6th day of September, 2019.

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RODNEY GILSTRAP
UNITED STATES DISTRICT JUDGE

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